Montana State Aviation System Plan - Phase IX
Pavement Condition Surveys & Analysis

INTRODUCTION

The 1997 Update to the Montana State Aviation System Plan (Phase IX), continues development of a Pavement Management System for Montana's general aviation airports. This is an ongoing process that was begun in 1988 in Phase II of the System Plan Update, and updated in 1991 and 1994 under Phases IV and VI of the System Plan. The Aeronautics Division of the Montana Department of Transportation, in coordination with the Federal Aviation Administration, Helena Airports District Office, contracted with Robert Peccia and Associates to provide the surveys and analysis required for this phase of the pavement management system development.

The pavement management system is designed to be a systematic, and objective tool for determining maintenance and rehabilitation needs and priorities for paved surfaces on Montana's general aviation airports. As such, it is intended to provide better information to airport and aviation officials, so that Federal, State, and local resources can be more efficiently allocated toward maintaining and improving airport pavements. The Pavement Condition Index (PCI) provides a dependable scale for comparing the existing operational condition and structural integrity of airport pavements. The pavement management system's PCI provides a rational basis for justifying pavement replacement or rehabilitation projects. It can also provide feedback on pavement performance to validate or revise pavement design, construction, and maintenance procedures.

The project consists of airport pavement records updates, map updates (FAA Form 5320-1), pavement condition surveys, PCI calculations, PCI analyses, PCI predictions, maintenance suggestions, and maintenance budget projections. The final report documents work completed, assesses system-wide conditions and potential, and recommends work for future updates to the pavement management system. Inspection results, PCI values, predictions, maintenance suggestions, and brief interpretation of the results were provided directly to the sponsor for each airport.

Airport maps and pavement records (FAA Form 5320-1) were updated in digital format for forty-five (45) airports. Of these, thirty-nine (39) had intensive field inspections of pavement samples, collecting data to estimate current and future airport conditions. Pavement deterioration at all fifty-eight (58) general aviation airports in Montana's database were predicted for the years 2002 and 2007 using the Pavement Condition Index.

Field surveys were performed in accordance with the criteria specified in Federal Aviation Administration (FAA) Advisory Circular AC 150/5380-6 "Guidelines and Procedures for Maintenance of Airport Pavements". Calculations, analysis, and predictions were accomplished using the U.S. Army Corps of Engineers Construction Engineering Research Laboratory's (USACERL) "MicroPAVER" software system (versions 4.0 and 4.1 Beta).

Table 1.1 and Figure 1.1 show the airports surveyed and analyzed in this project.

SCOPE OF WORK

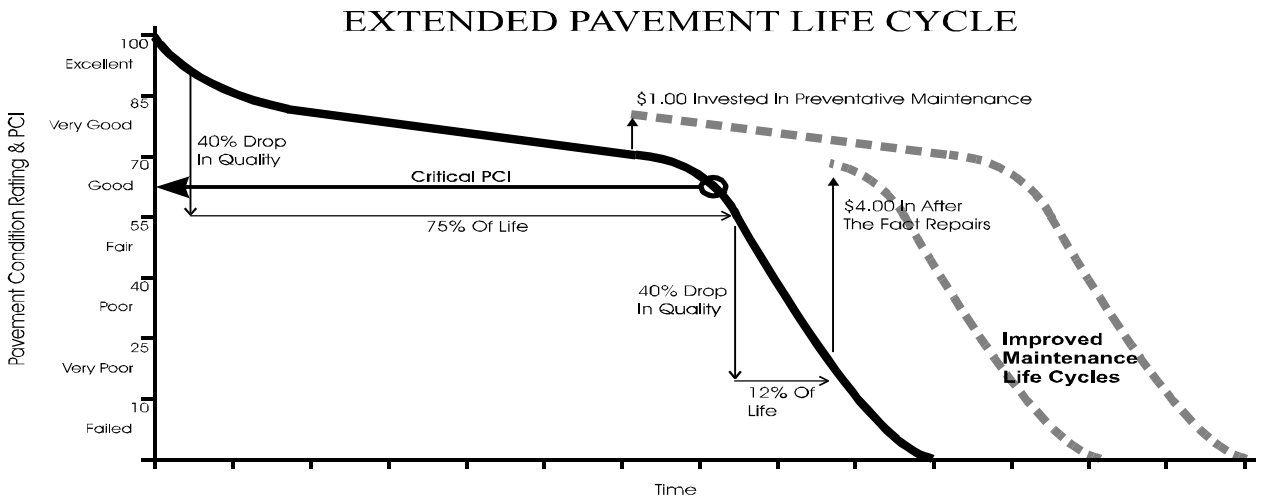
As part of the Montana State Aviation System Plan 1997 Update, Engineers from Robert Peccia & Associates (RPA) collected and updated airport geometric and pavement condition information for thirty-nine (39) airports, updated base maps (FAA Form 5320-1) for these and six (6) additional airports. They also defined pavement zones, branches, sections, and sample units for the six (6) new airport inspections and updated pavement network definitions for the remaining airports as needed. RPA engineers conducted visual condition surveys at 39 general aviation airports located throughout the state of Montana, loaded the survey data into MicroPAVER, obtained current PCI values for each section, and developed "Family Analysis Curves" to predict future pavement conditions. They updated the State's MicroPAVER database, analyzed pavements, and produced summary reports for each airport studied. Reports included ***Inspection Report Summaries, Maintenance Report Summaries, Inspection Photos, and FAA Form 5320-1 Updates***. The Owner and airport sponsors were provided with pavement analysis results and recommendations based on the study. Information gathered and analyzed during this project should help Montana Aeronautics and the Federal Aviation Administration (FAA) assess the effects of pavement design, construction, and maintenance practices on pavement life, and prioritize funding of airport improvement projects.

PROJECT APPROACH

This project is based on the Pavement Condition Index (PCI), a numerical index from 0 to 100 that describes the pavement's overall structural integrity and operational condition (100 = a new pavement with no flaws, 0 = a highly degraded pavement). The PCI is based on the types, severities, and quantities of pavement distresses measured during on-site visual inspections of representative samples of your airport's pavement. The included map shows locations of inspected samples (1997 "), as well as a classification of the airport into "Sections" of pavement such as A-1, R-1, and T-1 with consistent usage, age, construction materials, and maintenance history. Flaws, or "distresses," measured are listed by Section & Sample in the Inspections section of the included ***Inspection Report Summary***. Measured distresses are scaled up to approximate the flaws present in the entire section in the Extrapolated Distress Quantities section of the ***Inspection Report Summary***. Distresses are listed in order from most to least detrimental to aid in prioritizing repairs. The First Year Local: 1998 section of the ***Maintenance Report Summary*** projects costs for repairing the worst of the section distresses on an airport using only crack sealing and patching. The final section of the ***Inspection Report Summary*** lists "Loads" (overloading the pavements with large or overloaded aircraft, fuel trucks, and the like), "Climate/Durability" (extensive freeze-thaw cycling, snow plow scrapes, poor quality or aged binder, etc.), and "Other" (moisture destabilizing the subgrade, oil and fuel spills, etc.) as possible causes of pavement distress. Photographs documenting overall condition and/or specific distresses taken during the field surveys are included.

By grouping pavements with similar properties from across the state, documented behavior of older pavements were used to project probable future behavior for younger pavements and general trends emerged that helped predict the behavior of all pavements over the next 5-10 years. A representative group behavior is shown below as the thick-lined "Pavement Life Cycle" curve. The long period of slow aging followed by a rapid deterioration (see figure) has been confirmed in studies by U. S. Army Corps of Engineers Construction Engineering Research Laboratory. In fact, they contend it takes about 75% of the pavement's life to lose 40% of its quality. Amazingly, the next 40% drop in pavement quality normally occurs in just 12% of the pavement's life. The concept of a "Critical PCI" was developed as a way to signal the impending change in aging rate. Investments in preventative maintenance before the drop-off in quality that occurs shortly after the Critical PCI, significantly out-perform repairs completed after extensive degradation. Treating a problem before it spreads will give much longer pavement life for the dollar than delayed major repairs.

Preventative maintenance applied to pavements with conditions above, but near to the Critical PCI is the most economical extender of pavement life. "Local" and "Global" headers in the Fifteen Year Projections section of



the ***Maintenance Report Summary*** tally two types of preventative maintenance applied to sections above their critical PCI. For example, crack sealing is a common local preventative maintenance that stops moisture penetration into the subgrade, preserving subgrade integrity and extending pavement life. A global preventative maintenance such as fog sealing can significantly slow raveling, rebinding the aggregate into a high quality surface at a fraction of the cost of reconstruction.The sudden onset of rapid aging shortly after a pavement passes its Critical PCI begins to make pavement reconstruction cheaper than continued maintenance. Total reconstruction of a pavement section is prescribed when that section is below the critical PCI for its family curve, or if significant alligator cracking, rutting, and/other structural failures exist even above the critical PCI. Major repair of sections with PCI less than their Critical PCI, "Major<Crit," in the Fifteen Year Projections section of the ***Maintenance Report Summary***, assumes that the critical PCI was chosen such that reconstruction is a more economical option than continued maintenance once a section has passed below its critical PCI. While it is rare, structural failure of parts of a section may produce an unusable pavement that needs to be reconstructed even though it has a PCI rating above critical. This "Major>Crit" case can only be treated effectively by reestablishing a sound foundation for the surface layer.

PCI predictions are based on the assumption that current maintenance practices will continue with no major reconstruction. The Fifteen Year Projection of the ***Maintenance Report Summary*** assumes, rather unrealistically, that there is no annual cap on maintenance budgets in order to present a complete picture of possible repairs. This packet is meant not as a solution, but as an aid to the airport board in allocating their limited funds.

If you have any questions about this material, about the project, or about pavement construction and maintenance in general, please feel free to contact either of us at 1-800-667-8160, the Montana Aeronautics Division or the Federal Aviation Administration. Please provide this information to others that have an interest in the pavements at your airport. Additional copies are available upon request.

Sincerely yours,

ROBERT PECCIA & ASSOCIATES

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